

## CLAIMS

- 1 1. A gap-soliton structure comprising:
  - 2 a cladding structure having alternating layers of different index values; and
  - 3 a core region that is interposed between said alternating layers of index values,
  - 4 wherein
  - 5 said core or said cladding structure includes one or more nonlinear materials so as
  - 6 to achieve gap-soliton bistability.
- 1 2. The gap-soliton structure of claim 1, wherein said cladding structure and core region
- 2 form a photonic crystal fiber.
- 1 3. The gap-soliton structure of claim 2, wherein said photonic crystal fiber comprises a
- 2 Holey fiber.
- 1 4. The gap-soliton structure of claim 2, wherein said photonic crystal fiber comprises an
- 2 Omniguide fiber.
- 1 5. The gap-soliton structure of claim 1, wherein said core comprises said one or more
- 2 nonlinear materials in a defined region.
- 1 6. The gap-soliton structure of claim 1, wherein said cladding structure comprises said
- 2 one or more materials.
- 1 7. A method of forming a gap-soliton structure comprising:
  - 2 forming a cladding structure having alternating layers of different index values;

3 forming a core region that is interposed between said alternating layers of index  
4 values; and  
5 providing in said core or said cladding structure one or more nonlinear materials  
6 so as to achieve gap-soliton bistability.

1 8. The method of claim 7, wherein said said cladding structure and core region form a  
2 photonic crystal fiber.

1 9. The method of claim 8, wherein said photonic crystal fiber comprises a Holey fiber.

1 10. The method of claim 8, wherein said photonic crystal fiber comprises an Omniguide  
2 fiber.

1 11. The method of claim 7, wherein said core comprises said one or more nonlinear  
2 materials in a defined region.

1 12. The method of claim 7, wherein said cladding structure comprises said one or more  
2 materials.

1 13. A gap-soliton structure comprising:

2 a cladding structure having alternating layers of different index values; and  
3 a core region that is interposed between said alternating layers of index values,  
4 wherein either said core or said cladding structure is indicative to enhancing said gap-  
5 soliton bistability of said structure.

1 14. The gap-soliton structure of claim 13, wherein said said cladding structure and core  
2 region for a photonic crystal fiber.

1 15. The gap-soliton structure of claim 14, wherein said photonic crystal fiber comprises a  
2 Holey fiber.

1 16. The gap-soliton structure of claim 14, wherein said photonic crystal fiber comprises  
2 an Omniguide fiber.

1 17. The gap-soliton structure of claim 13, wherein said core comprises said one or more  
2 nonlinear materials in a defined region.

1 18. The gap-soliton structure of claim 13, wherein said cladding structure comprises said  
2 one or more materials.

1 19. A method of forming a gap-soliton structure comprising:  
2 forming a cladding structure having alternating layers of different index values;  
3 and

4 forming a core region that is interposed between said alternating layers of index  
5 values so that either said core or said cladding structure is indicative to enhancing said  
6 gap-soliton bistability of said structure.

1 20. The method of claim 19, wherein said said cladding structure and core region for a  
2 photonic crystal fiber.

1 21. The method of claim 20, wherein said photonic crystal fiber comprises a Holey fiber.

1 22. The method of claim 20, wherein said photonic crystal fiber comprises an Omniguide  
2 fiber.

1 23. The method of claim 19, wherein said core comprises said one or more nonlinear  
2 materials in a defined region.

1 24. The method of claim 19, wherein said cladding structure comprises said one or more  
2 materials.

1 25. The gap-soliton structure of claim 1, wherein said core performs single mode guiding  
2 of light.

1 26. The gap-soliton structure of claim 1, wherein said core comprises a modified core  
2 portion in which propagation is not allowed.

1 27. The gap-soliton structure of claim 1, wherein said cladding structure comprises a  
2 modified cladding portion in which propagation is not allowed.

1 28. The gap-soliton structure of claim 26, wherein said modified core portion comprises  
2 said one or more nonlinear materials.

1 29. The gap-soliton structure of claim 27, wherein said modified cladding portion  
2 comprises said one or more nonlinear materials.

1 30. The method of claim 7, wherein said core performs single mode guiding of light.

1 31. The method of claim 7, wherein said core comprises a modified core portion in  
2 which propagation is not allowed.

1 32. The method of claim 7, wherein said cladding structure comprises a modified  
2 cladding portion in which propagation is not allowed.

- 1 33. The method of claim 31, wherein said modified core portion comprises said one or  
2 more nonlinear materials.
- 1 34. The method of claim 32, wherein said modified cladding portion comprises said one  
2 or more nonlinear materials.
- 1 35. The gap-soliton structure of claim 13, wherein said core performs single mode  
2 guiding of light.
- 1 36. The gap-soliton structure of claim 13, wherein said core comprises a modified core  
2 portion in which propagation is not allowed.
- 1 37. The gap-soliton structure of claim 13, wherein said cladding structure comprises a  
2 modified cladding portion in which propagation is not allowed.
- 1 38. The gap-soliton structure of claim 36, wherein said modified core portion comprises  
2 said one or more nonlinear materials.
- 1 39. The gap-soliton structure of claim 37, wherein said modified cladding portion  
2 comprises said one or more nonlinear materials.
- 1 40. The method of claim 19, wherein said core performs single mode guiding of light.
- 1 41. The method of claim 19, wherein said core comprises a modified core portion in  
2 which propagation is not allowed.
- 1 42. The method of claim 19, wherein said cladding structure comprises a modified  
2 cladding portion in which propagation is not allowed.

1 43. The method of claim 41, wherein said modified core portion comprises said one or  
2 more nonlinear materials.

1 44. The method of claim 42, wherein said modified cladding portion comprises said one  
2 or more nonlinear materials.